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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

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To:

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in its capacity as elected Office

Date of mailing: 11 November 1999 (11.11.99)	
International application No.: PCT/GB99/01302	Applicant's or agent's file reference: 03 33746
International filing date: 27 April 1999 (27.04.99)	Priority date: 01 May 1998 (01.05.98)
Applicant: LEBRE, Caroline, Anne, Michele et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International preliminary Examining Authority on:
18 September 1999 (18.09.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer: J. Zahra Telephone No.: (41-22) 338.83.38
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WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



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(21) International Application Number: PCT/GB99/01302 (22) International Filing Date: 27 April 1999 (27.04.99) (30) Priority Data: 9809512.8 1 May 1998 (01.05.98) GB (71) Applicant (for all designated States except US): BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY [GB/GB]; 81 Newgate Street, London EC1A 7AJ (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): LEBRE, Caroline, Anne, Michele [FR/GB]; 7 High View House, Dykes Street, Ipswich, Suffolk IP1 3NB (GB). TITMUS, Richard, John [GB/GB]; 27 King Edward Road, Ipswich, Suffolk IP4 3AN (GB). (74) Agents: READ, Matthew, Charles et al.; Venner, Shipley & Co., 20 Little Britain, London EC1A 7DH (GB).		(81) Designated States: AU, CA, CN, JP, SG, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>	
(54) Title: DISTRIBUTED DATA PROCESSING			
(57) Abstract			
<p>Data is processed in a distributed environment, using client and server objects. The server object (MS1) is mobile and can be serialised under control of a proxy (<i>pr1</i>) and moved from a first place (<i>P1</i>) to a second place (<i>P2</i>). During relocation, calls to the mobile server are frozen and redirected to the new location when the server becomes ready for use at the second place (<i>P2</i>).</p>			

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Distributed data processing

Field of the invention

This invention relates to a processing data in a distributed computing
5 environment.

Background

Data processing may be carried out in a distributed computing environment in which client software interacts with server software, connected in a network. A
10 server can be considered to have a resource which is to be shared with a number of clients which have an interest in it. The server waits for client initiated requests and replies to them individually with information derived from the resource requested by the client.

15 Conventionally, the client software is located at fixed workstations connected in the network, which interacts with servers at fixed locations. More recently, mobile agent software has been developed which allows the client software to move to a location close to a server in order to make better use of the facilities of the server. For example, if a manufacturing company has factories at two
20 different locations, with their own local computer networks, an operator at the first location may wish to interrogate databases of servers at both locations to determine e.g. the availability of certain stock items which may be held in warehouses at the two locations. In this situation, it is convenient for the client data interrogation software to migrate from the first location to the second
25 location in order to be close to the server at the second location, to enable the associated databases to be interrogated efficiently. The mobile client software is known as a mobile agent.

A number of different systems which provide mobile agents have been
30 developed: MuBot by Crystaliz, Inc., Agent Tcl by Dartmouth College, Aglets by IBM, MOA by the Open Group Inc, GMAF/Magna by GMD Fokus and Odyssey by General Magic Inc.

Summary of the invention

In accordance with the invention, it has been appreciated that there are situations in which it would be advantageous to make the server mobile within a distributed computing environment.

In accordance with the invention there is provided a method of processing data in a distributed computing environment wherein a client and a server process data, the method comprising sending the server from a first place where it communicates with the client, through the distributed computing environment towards a second different place to perform data processing therefrom.

The method may include freezing incoming calls for data processing to the server at the first place whilst the server is being sent from the first place to the second place, and thereafter directing the frozen calls towards the second place to be processed by the server when it has become functional at the second place. This has the advantage of ensuring that connections are not lost to the server whilst it moves from the first place to the second place.

In another aspect, the invention includes, at the second place, receiving the server sent from the first place in order to perform data processing at the second place.

In order to transmit the server from the first place to the second place, it may be converted from an operational configuration at the first place into a configuration suitable for transmission through the distributed environment to the second place. The conversion may comprise serialisation of the server.

The invention also includes a software entity operable to provide a server for a client in a distributed computing environment characterised in that the software entity is selectively re-locatable to different places through the environment.

In another aspect, the invention includes a signal for transmission in a distributed computing environment wherein a client and a server process data, the signal comprising the server serialised for transmission between a first place where it communicates with the client, through the distributed computing
5 environment and a second different place to perform data processing.

The transmission of the server from the first place towards the second place may be controlled by a proxy and more particularly, the invention includes a proxy for use in a distributed computing environment wherein a client and a server
10 process data, the proxy being operable to send the server from a first place where it communicates with the client, through the distributed computing environment towards a second different place to perform data processing.

Brief description of the drawings

15 In order the invention may be more fully understood, an embodiment thereof will now be described way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic block diagram of a distributed computing environment which uses mobile software agents;

20 Figure 2 is a more detailed diagram of one of the hosts shown in Figure 1;

Figure 3 illustrates schematically the moving of a mobile server from a first place to a second place in accordance with the invention; and

Figure 4 is a schematic timing diagram of signal communication between the first place and the second place in respect of the movement of the server.

25

Detailed description

In the following description, the terminology adopted by the Object Management Group (OMG) for mobile agents has been adopted by way of convenient explanation. The OMG has defined a common standard for
30 interoperability of objects between different systems under a common object management architecture that provides an object request broker known commercially as CORBA which provides an infrastructure allowing objects to

converse independently of the specific platforms and techniques used to implement the objects. In order to deal with interoperability of mobile agents, the OMG has produced a document "Mobile Agent Facility Specification" 1st September 1997, OMG TC Document orbos/97-09-20, available from the
5 Object Management Group, 492 Old Connecticut Path, Framingham, MA 01707, USA. Members of OMG can also find the full specification at the following URL:

http://www.omg.org/library/schedule/Mobile_Agents_Facility_RFP.htm.

This will now be explained with reference to Figures 1 and 2.

10

For mobile software agents, which are clients, the world is made up of regions which include places between which the mobile agent can move. Referring to Figure 1, first and second host computing systems 1, 2 are interconnected by a network 3. The first and second host systems can be of any suitable form e.g.
15 local area networks, individual computers and the like, which each operate with their own operating system *OS1*, *OS2*. In a conventional manner, the individual hosts 1, 2, may include one or more computers or processors, each of which include a processor, volatile working memory and non-volatile data storage. Each host is provided with a communications interface *CI1*, *CI2* to allow
20 communication between them via the network 3. The network 3 can be of any suitable form, for example a wide area network, a local area network, intranet or Internet.

Considering the host 1, its operating system *OS1* provides an environment in
25 which software can operate. The client software is configured as mobile software agent *MA1*. Similarly, the host 2 has an operating system *OS2* and a mobile agent *MA2*. A further mobile agent *MA_n* is shown in host 1. Each mobile agent *MA* is operative at a place *P*. Thus, considering the host 1, mobile agent *MA1* is operative at place *P1* and mobile agent *MA_n* is operative at place
30 *P_n*. Mobile agent *MA2* is at place *P2* in host 2. The mobile agents can move from place to place. It will be understood that in host 1, the places *P* may be individual computers connected in a network that comprises host 1 or any other

suitable hardware configuration, which will not be described further herein. The same is true for host 2. The OMG mobile agent specification is designed to provide interoperability between different operating systems in order to allow transport of mobile client agents from one host to another. It is assumed in the configuration of Figure 1 that different operating systems *OS1*, *OS2* are in use although this is not an essential feature of the invention. It will be appreciated that the OMG specification makes use of CORBA to allow interoperability between different hardware and software configurations. The agents operating within the operating system *OS1* define an agent system *AS1* in host 1. A similar agent system *AS2* operates in host 2 shown in Figure 1.

The software process is arranged in a client-server configuration as will now be explained with reference to Figure 2. Conveniently, but not necessarily, the software may be object oriented such that the mobile client agents and the servers can each be considered as objects. As shown in Figure 2, server software *MS 1* is shown at place *P1* which can service calls from the mobile clients described with reference to Figure 1. For example, the mobile agent *MA1* is a client at place *P1* and can make data calls on the server *MS 1* over path 4 to perform data processing. The client and server do not however need to be located at the same place *P*. Thus, in the example of Figure 2, the server *MS1* can service data calls from mobile client agent *MA 2* at place *P2* over communication path 5. It will be understood that there may be more than one server *MS* in the distributed computing environment.

In accordance with the invention, the server *MS 1* is mobile within the distributed computing environment. In order to manage the mobility of the mobile server *MS 1*, it is given a software proxy *pr 1* which is different in each place *P*. The proxy *pr 1* is advertised to CORBA with the mobile server interface, instead of the mobile server itself. All processing calls for the server go to the proxy first and are then redirected by it to the server. Therefore, the proxy *pr 1* knows at all times how many clients are connected to the server *MS 1* and how many calls are in progress.

Referring to Figure 3, there are situations where it would be convenient to move the server agent *MS1* from place *P1* to place *P2* via the communication interface *CI1*, network 3 and interface *CI2*. For example, the server *MS 1* could then
5 function with enhanced operability with client *MA 2* residing in the agent system *AS2* in host 2. The transfer of the server *MS 1* from place *P1* to place *P2* will now be described in detail with reference to Figure 4.

Initially, when the mobile server *MS 1* decides or is told to move from place *P1*,
10 at step S.0, it tells its proxy *pr1* the place to which it is to be moved. In this case, the mobile server *MS1* is to be moved to place *P2*. Alternatively, the proxy *pr1* may be told by some external third party to move the mobile server. The moving process then starts.

15 At step S.1, the proxy *pr1* freezes all incoming calls for data processing to the mobile server *MS 1*.

At step S.2, the proxy *pr1* waits until all current data processing handled by mobile server *MS 1* has finished.

20

Then, at step S.3, the proxy *pr1* tells mobile server *MS 1* that it is about to be moved and that it must perform any task needed to be completed before leaving place *P1*.

25 Then, at step S.4, the proxy causes the mobile server *MS 1* to be serialised, namely to convert it from its operational state into a condition suitable for transmission through the network 3 (Figure 1).

Then, at step S.5, the serialised mobile server is sent to the place *P2* of host 2 via
30 communications interface *CI1*, network 3 and communications interface *CI2*.

At step S.6, a new proxy *pr1'* is produced in place *P2* for the mobile server *MS1*

when located in place *P2*.

At step S.7, the mobile server *MS1* is de-serialised at place *P2* and thereby recreated in an operational condition.

5

At step S.8, the newly created proxy *pr1'* sends back locational reference data for mobile server *MS1*, so as to indicate to the proxy *pr1*, the new CORBA reference of mobile server *MS1*.

10 Then, at step S.9, the calls frozen at step S.1 are forwarded to the mobile server *MS1* through the network 3, by proxy *pr1*, from place *P1* to place *P2*.

The procedure described with reference to Figure 4 has the advantage that communication with the mobile server *MS 1* is not lost during the transfer
15 process. The steps ensure that any data processing carried out at place *P1* is completed before the transfer occurs and, whilst the transfer is taking place, incoming calls are frozen and then transferred to the new place.

Clients can find the moved mobile server *MS 1* by making an appropriate
20 request, as for any other CORBA object, and will receive the reference of its proxy. The proxy that is advertised for the mobile agent can either be the first one *pr1*, in which case calls will be directed from *pr1* to *pr1'*, or *pr1'* itself.

At the completion of the moving process for the mobile server, the proxy *pr 1* is
25 no longer needed and is cancelled.

It will be understood that client agents such as agent *MA2* shown at place *P1* in Figure 3 can be mobile in a conventional manner, in accordance with the OMG specification for mobile agents. Thus, client agent *MA2* can be moved in a
30 conventional manner by serialising the agent, transmitting it through the network 3 to a different place and de-serialising the agent at the new place. Thus, it is possible according to the invention to move an entire client - server

combination from one place to another or to different places.

It will be understood that the mobile server MS1 when at a particular place, will reside in the working memory of a particular computer within the host, and
5 may if required be stored in the non-volatile memory of the computer associated with the place *P*, to provide a record thereof if the network or a part thereof is shut down. The mobile server may also be provided on a storage medium such as an optical or magnetic disc, so that it can be loaded into a computer at a particular place *P*, and then commence its mobile activities in the network.

10

Whilst the previously described clients and servers may conveniently be configured as software objects in an object oriented environment, this is not essential and they can be configured as batches of conventional code. Also, whilst the invention has been described in relation to CORBA object
15 management architecture, other management architectures could be used such as OLE by Microsoft, suitably configured to handle mobile objects

Movement of the server in accordance with the invention renders the computing process much more flexible. For example in an Internet application, if a large
20 number of clients in the United Kingdom are calling a server which is located at a place in the USA, a large number of transatlantic calls would need to be set up, leading to inefficiencies. In accordance with the invention, the server object can migrate from a place in the USA to a place in the United Kingdom, speeding up execution of the individual client/server processes.

Claims

1. A method of processing data in a distributed computing environment
5 wherein a client and a server process data, the method comprising sending the server from a first place where it communicates with the client, through the distributed computing environment towards a second different place to perform data processing therefrom.
- 10 2. A method according to claim 1 including freezing incoming calls for data processing to the server at the first place whilst it is being sent from the first place to the second place, and thereafter directing the frozen calls towards the second place to be processed by the server when it has become functional at the second place.
- 15 3. A method according to claim 2 including waiting for the server to complete its current processing tasks before sending it to the second place.
4. A method according to any preceding claim including converting the
20 server from an operational configuration at the first place into a configuration suitable for transmission through the distributed environment to the second place.
5. A method according to claim 4 wherein the conversion comprises
25 serialisation of the server.
6. A method according to any preceding claim including creating a proxy for the server at the first place, which controls the sending of the server towards the second place.
- 30 7. A method according to any preceding claim including sending the client towards a different place in the distributed computing environment.

8. A method of processing data in a distributed computing environment wherein a client and a server process data, the method comprising receiving the server sent from a first place where it communicated with the client, through the distributed computing environment, at a second different place, to perform data processing at the second place.

9. A method according to claim 8 wherein the server is received at the second place in a form suitable for transmission through the distributed environment, and including converting the received server at the second place into a form suitable for processing data at the second place.

10. A method according to claim 9 wherein the converting includes deserialising the server.

15

11. A method according to claim 8, 9 or 10 including producing a proxy for the received server, at the second place.

12. A method according to any one of claims 8 to 11 including receiving at the second place, data processing calls for the server directed thereto from the first place after the server has become operational at the second place.

13. A software entity operable to provide a server for a client in a distributed computing environment **characterised in that** the software entity is selectively re-locatable to different places through the environment.

14. An entity according to claim 13, operable to function as the server at a first place in the environment and then to re-locate and function as the server at a second place in the environment.

30

15. An entity according to claim 13 or 14, operable such that data calls thereto from a client are frozen during the re-location.

16. An entity according to any one of claims 13 to 15 operable to provide a proxy functional to send the server through the environment to achieve the re-location.
- 5 17. An entity according to claim 16 wherein the proxy is functional to wait for the server to complete its current processing tasks before commencing the re-location.
- 10 18. An entity according to claim 16 or 17 wherein the proxy is operable to serialise the server from its functional configuration into a configuration suitable for transmission through the distributed environment so as to achieve the re-location.
- 15 19. A software entity according to any one of claims 13 to 18, stored on a storage medium.
20. A signal for transmission in a distributed computing environment wherein a client and a server process data, the signal comprising the server
20 serialised for transmission between a first place where it communicates with the client, through the distributed computing environment and a second different place to perform data processing.
21. A proxy for use in a distributed computing environment wherein a client
25 and a server process data, the proxy being operable to send the server from a first place where it communicates with the client, through the distributed computing environment towards a second different place to perform data processing.
22. A proxy according to claim 21 operable to freeze incoming calls for data
30 processing to the agent at the first place whilst it is being sent from the first place to the second place, and thereafter to direct the frozen calls towards the second place to be processed by the server when it has become functional at the second

place.

23. A proxy according to claim 21 or 22 operable to wait for the server to complete its current processing tasks before sending it to the second place.

5

24. A proxy according to claim 21, 22 or 23 operable to serialise the server from an operational configuration at the first place into a configuration suitable for transmission through the distributed environment to the second place.

10 25. A host provided with client and server objects for processing data in an object oriented distributed processing environment **characterised in that** the server object is selectively re-locatable to different places in the environment.

26. A host according to claim 25 wherein the mobile server object is operable
15 such that data calls thereto are frozen during the relocation.

27. A host according to claim 25 wherein the server is provided with a proxy compatible with CORBA or OLE architecture.

20 28. A server object for processing data in an object oriented distributed processing environment **characterised in that** the server object is re-locatable for operation at different places and is provided in use with a proxy which freezes data calls thereto during the relocation and subsequently forwards them to the moved server object.

25

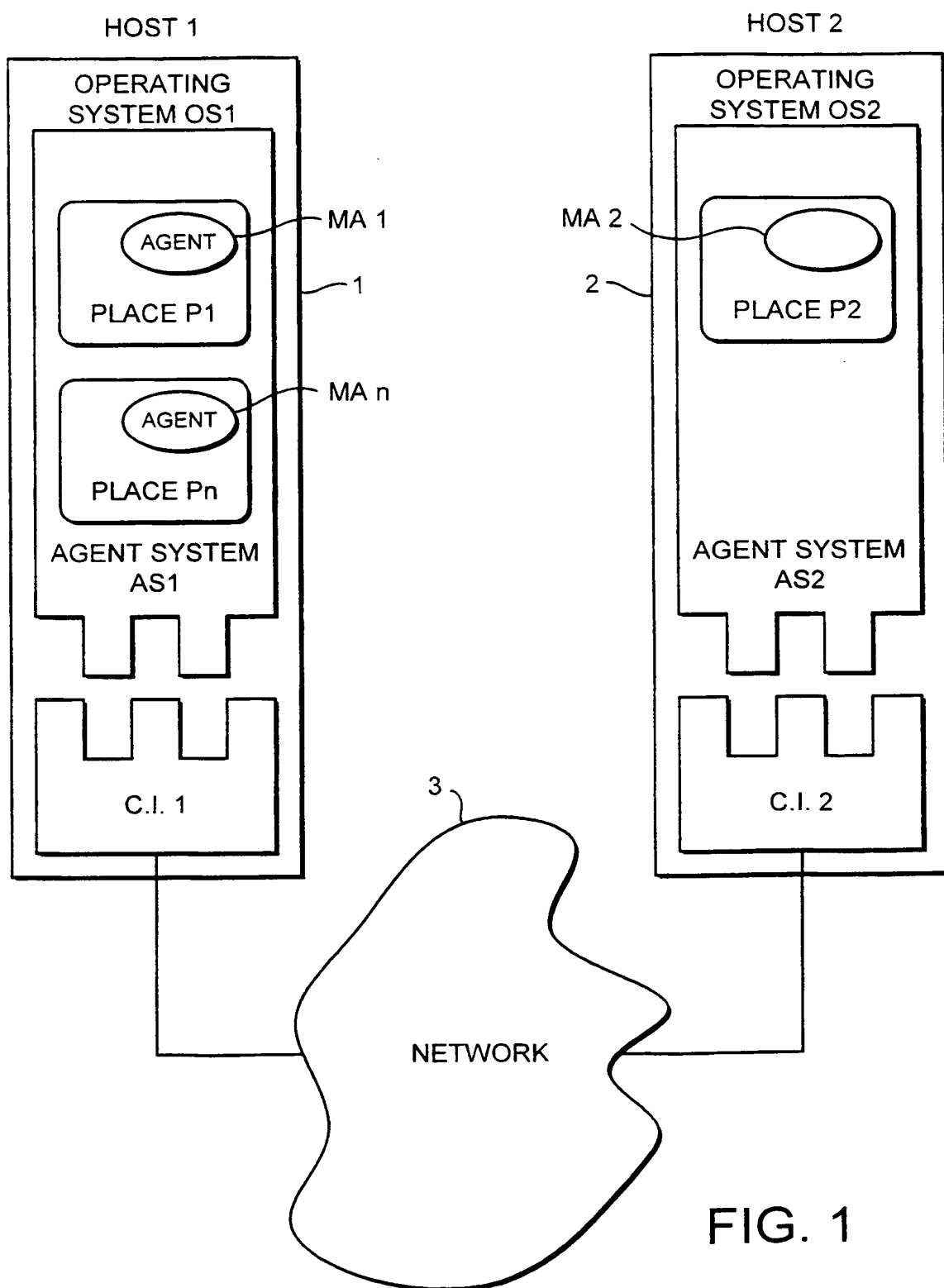


FIG. 1

2 / 3

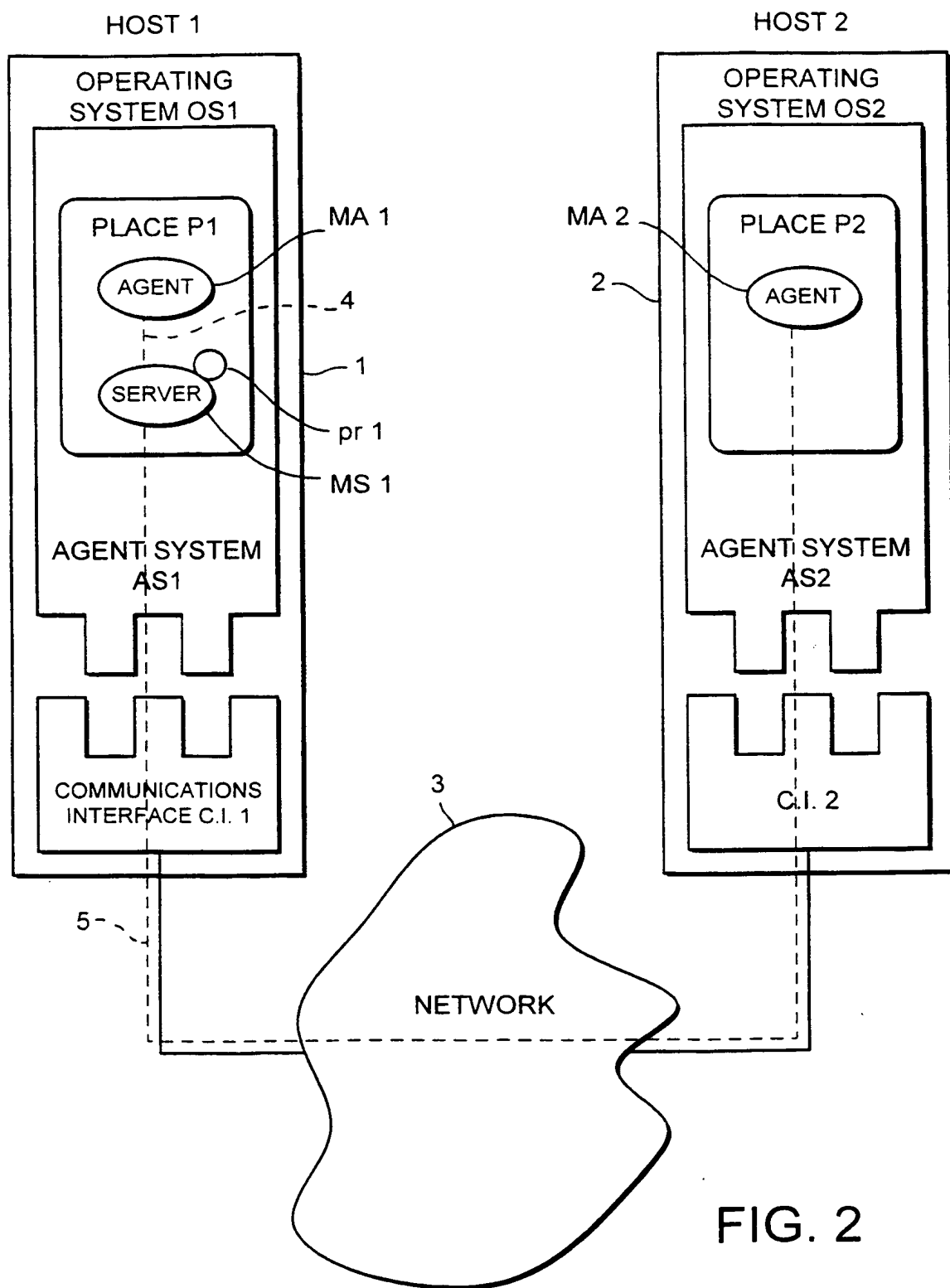


FIG. 2

3 / 3

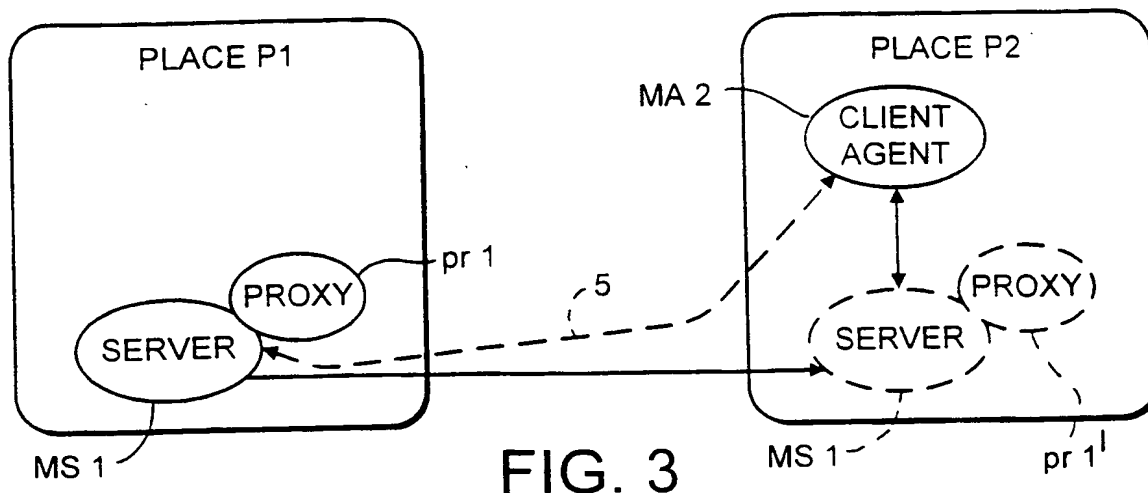


FIG. 3

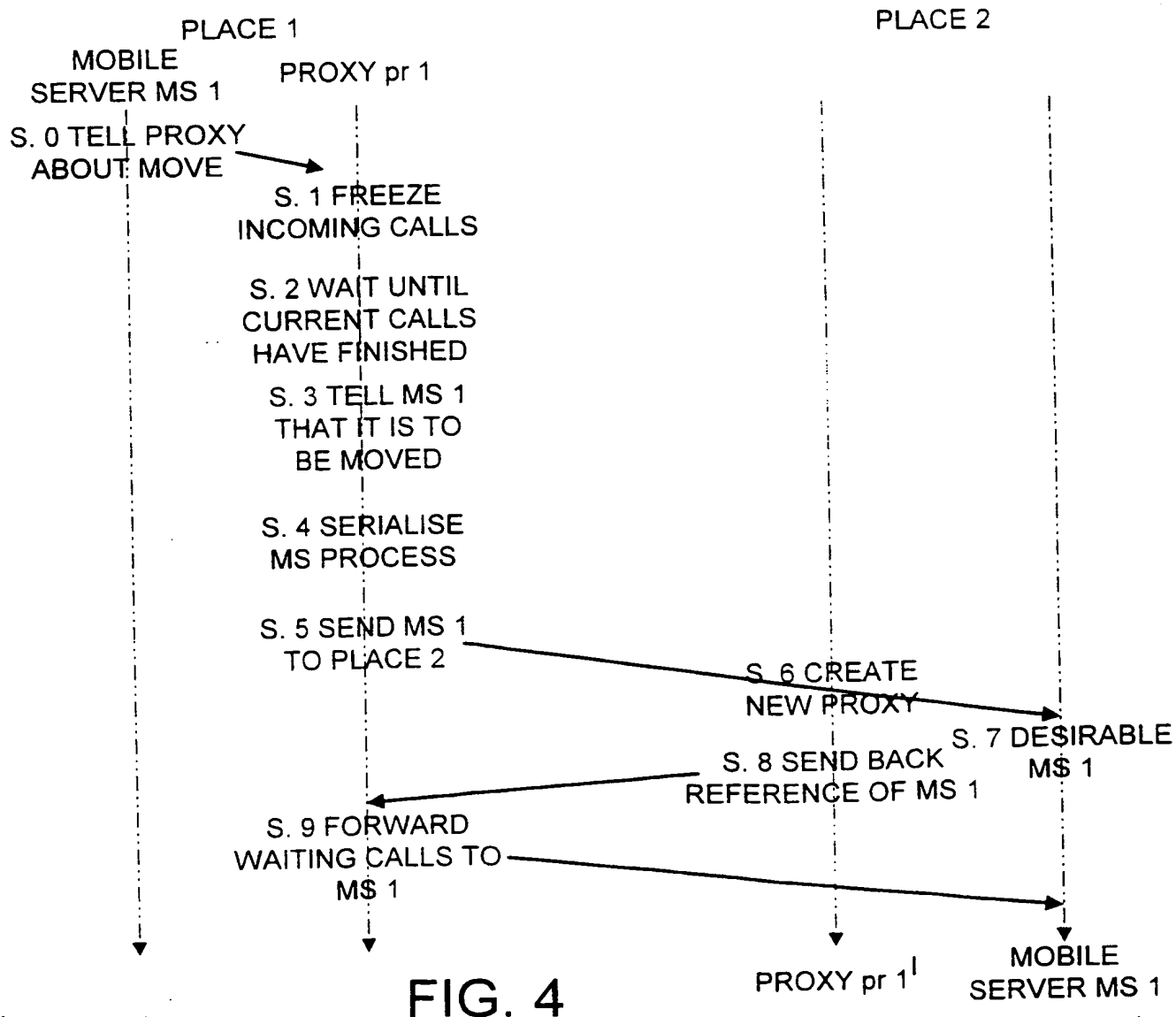


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/01302

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G06F9/46

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	BERGHOFF J ET AL: "Agent-based configuration management of distributed applications" PROCEEDINGS. THIRD INTERNATIONAL CONFERENCE ON CONFIGURABLE DISTRIBUTED SYSTEMS (CAT. NO.96TB100046), PROCEEDINGS OF INTERNATIONAL CONFERENCE ON CONFIGURABLE DISTRIBUTED SYSTEMS, ANNAPOLIS, MD, USA, 6-8 MAY 1996, pages 52-59, XP002086942 ISBN 0-8186-7395-8, 1996, Los Alamitos, CA, USA, IEEE Comput. Soc. Press, USA the whole document ---	1-28
A	WO 97 47091 A (ADOBE SYSTEMS INC) 11 December 1997 (1997-12-11) the whole document ---	1,8,13, 14,20, 25,28
	-/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

22 July 1999

Date of mailing of the international search report

29/07/1999

Name and mailing address of the ISA

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Fonderson, A

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/01302

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>RAVI T M ET AL: "A basic protocol for routing messages to migrating processes" PROCEEDINGS OF THE 1988 INTERNATIONAL CONFERENCE ON PARALLEL PROCESSING, UNIVERSITY PARK, PA, USA, 15-19 AUG. 1988, pages 188-197 vol.2, XP002090982 ISBN 0-271-00654-4, 1988, University Park, PA, USA, Pennsylvania State Univ, USA the whole document</p> <p>-----</p>	<p>1,2, 13-15, 21,22, 25,26,28</p>

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/01302

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9747091 A	11-12-1997	US 5838909 A AU 3145897 A	17-11-1998 05-01-1998
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PATENT COOPERATION TREATY

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REC'D 17 JUL 2000

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 03 33746	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB99/01302	International filing date (day/month/year) 27/04/1999	Priority date (day/month/year) 01/05/1998
International Patent Classification (IPC) or national classification and IPC G06F9/46		
Applicant BRITISH TELECOMMUNICATIONS PUBLIC LIMITED..et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 18/09/1999	Date of completion of this report 12.07.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Thibaudeau, J Telephone No. +49 89 2399 2349 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/01302

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-8 as originally filed

Claims, No.:

1-28 as originally filed

Drawings, sheets:

1-3 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB99/01302

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-28
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-28
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-28
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/01302

1. Reference is made to the following document:

D1: BERGHOFF J ET AL: 'Agent-based configuration management of distributed applications' PROCEEDINGS. THIRD INTERNATIONAL CONFERENCE ON CONFIGURABLE DISTRIBUTED SYSTEMS (CAT. NO.96TB100046), PROCEEDINGS OF INTERNATIONAL CONFERENCE ON CONFIGURABLE DISTRIBUTED SYSTEMS, ANNAPOLIS, MD, USA, 6-8 MAY 1996, pages 52-59, XP002086942 ISBN 0-8186-7395-8, 1996, Los Alamitos, CA, USA, IEEE Comput. Soc. Press, USA

2. **Item V: Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

As far as they can be understood (see objection of lack of clarity under item VIII), the claims seem to meet the criteria set forth in Article 33(1) PCT with respect to the available prior art.

Indeed the prior art documents, although disclosing mobile agents, do not seem to disclose nor suggest a mobile server.

3. **Item VII: Certain defects in the international application**

i) To meet the requirements of Rule 6.3(b) PCT the independent claims should have been properly cast in the two part form, with those features which in combination are part of the prior art (see document D1) being placed in the preamble.

ii) The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

iii) Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

4. **Item VIII: Certain observations on the international application**

The application does not meet the requirements of Article 6 PCT, because claims 1, 8, 13, 20, 21, 25 and 28 are not clear.

Indeed said claims are drafted in such a way as to attempt to define the subject-matter in terms of the result to be obtained (making a server mobile within a distributed environment (see page 2, line 3 presenting the result to be achieved)). Indicating that a server, which is in an operational configuration or which communicates with a client at a first place, is sent to a second place different from the first place, where it is also in an operational configuration and can perform data processing, is merely rephrasing the fact that said server has been made mobile.

Therefore claims 1, 8, 13, 21, 25 and 28 do not define the technical means necessary for achieving the desired result. Such a formulation does not meet the requirements of Article 6 PCT since the man skilled in the art would have to employ an inventive step in order to find a solution to the problem posed.

Although the set of claims comprises several independent claims in the same category (method claims 1 and 8, software claims 13, 21 and 28), it seems however to be concise. Indeed method claim 1 claims a method for sending the server and method claim 8 claims the corresponding receiving method. Claim 13 claims a software entity which is operable to function as a server and is operable to provide a proxy functional to send the server to achieve relocation. Claims 21 claims the corresponding proxy and claim 28 claims the corresponding server object.

2 AUG 1999

PATENT COOPERATION TREATY

SCR

From the INTERNATIONAL SEARCHING AUTHORITY

ACTION DUE

29 SEP 1999

PCT

To:

VENNER, SHIPLEY & CO.
Attn. READ, M.
20 Little Britain
London EC1A 7DH
UNITED KINGDOM

IPSS ENTRY CHECKING

RECORD CREATED/EDITED

DIARY INPUT

CHECKED

37887

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing
(day/month/year)

29/07/1999

Applicant's or agent's file reference

03 33746

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/GB 99/ 01302 ✓

International filing date
(day/month/year)

27/04/1999 ✓

Applicant

BRITISH TELECOMMUNICATIONS PUBLIC LIMITED..et al.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Fascimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040. Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Ahmed Soliman

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 03 33746	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 99/ 01302	International filing date (day/month/year) 27/04/1999	(Earliest) Priority Date (day/month/year) 01/05/1998
Applicant BRITISH TELECOMMUNICATIONS PUBLIC LIMITED..et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. _____

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☒ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/01302

CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F9/46

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	BERGHOFF J ET AL: "Agent-based configuration management of distributed applications" PROCEEDINGS. THIRD INTERNATIONAL CONFERENCE ON CONFIGURABLE DISTRIBUTED SYSTEMS (CAT. NO.96TB100046), PROCEEDINGS OF INTERNATIONAL CONFERENCE ON CONFIGURABLE DISTRIBUTED SYSTEMS, ANNAPOLIS, MD, USA, 6-8 MAY 1996, pages 52-59, XP002086942 ISBN 0-8186-7395-8, 1996, Los Alamitos, CA, USA, IEEE Comput. Soc. Press, USA the whole document ---	1-28
A	WO 97 47091 A (ADOBE SYSTEMS INC) 11 December 1997 (1997-12-11) the whole document ---	1,8,13, 14,20, 25,28
-/--		

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

22 July 1999

Date of mailing of the international search report

29/07/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Fonderson, A

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/01302

(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>RAVI T M ET AL: "A basic protocol for routing messages to migrating processes" PROCEEDINGS OF THE 1988 INTERNATIONAL CONFERENCE ON PARALLEL PROCESSING, UNIVERSITY PARK, PA, USA, 15-19 AUG. 1988, pages 188-197 vol.2, XP002090982 ISBN 0-271-00654-4, 1988, University Park, PA, USA, Pennsylvania State Univ, USA the whole document</p> <p>-----</p>	<p>1,2, 13-15, 21,22, 25,26,28</p>

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB·99/01302

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9747091 A	11-12-1997	US 5838909 A AU 3145897 A	17-11-1998 05-01-1998